

## ***Vigna triodiophila* (Fabaceae: Phaseoleae), a new conservation-listed species from the Pilbara, Western Australia**

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### **Abstract**

Holland, A.E. & Butcher, R. *Vigna triodiophila* (Fabaceae: Phaseoleae), a new conservation-listed species from the Pilbara, Western Australia. *Nuytsia* 27: 77–83. The new species described herein came to light during botanical surveys of the Burrup Peninsula and surrounds in 2000; it is geographically restricted to basalt rockpile habitats in the north-west of the Pilbara bioregion. *Vigna triodiophila* A.E.Holland & R.Butcher is diminutive in all its parts and can be readily distinguished from other *Vigna* Savi taxa in the Pilbara by its small (to 2.3(–3) cm long × to 1.6(–2.1) cm wide), ovate to elliptic leaflets which lack lateral lobing. The species has a conservation listing of Priority Three in Western Australia.

### **Introduction**

The genus *Vigna* Savi is a pantropical herbaceous legume genus of about 200 species distributed throughout the tropics and subtropics of both hemispheres and includes many important pulse crops (Smartt & Hymanowitz 1985; Fery 2002). In Australia, *Vigna* species are a significant traditional food source for several aboriginal groups (Lawn & Cottrell 1988). The native *Vigna* species occur in a wide range of habitats from wet coastal forests to monsoonal savannahs, from fertile cracking clays to sandy arid landscapes (Council of Heads of Australasian Herbaria 2015). They usually occur as a minor component within a highly variable herbaceous legume flora, but sometimes assume local dominance (Lawn & Watkinson 2002). The contribution of these taxa to ecosystem processes in terms of soil fertility, stability, and as a food source is not fully understood although there is anecdotal evidence of predation of seeds by parrots, insects and small marsupials (R.J. Lawn pers. comm. 2004). Ants are a frequent visitor to inflorescences which have well-developed extra-floral nectaries, situated between each pair of flowers.

In Western Australia, *Vigna* comprises 12 native taxa, including three undescribed taxa, and one introduced species (*Vigna trilobata* (L.) Verdc.), from the Eremaean and Northern Botanical Provinces (Western Australian Herbarium 1998–). The most widespread species is *V. lanceolata* Benth. In the Eremaean Province, *Vigna* has mostly been collected from the Pilbara bioregion during botanical surveys

associated with mining and industrial development, and the following taxa are currently recorded: *V. lanceolata* var. *lanceolata*, *V. sp.* Hamersley Clay (A.A. Mitchell PRP 113) and *V. sp.* rockpiles (R. Butcher et al. RB 1400). Two previously recognised phrase names have now been synonymised: *V. sp.* silver leaf (T.E.H. Aplin 6300) under *V. lanceolata s. str.*, and *V. sp.* central (M.E. Trudgen 1626) under *V. sp.* Hamersley Clay (Butcher & Dillon 2016).

In this paper *V. sp.* rockpiles is described as the new species *V. triodiophila* A.E.Holland & R.Butcher, *sp. nov.* The taxon was collected for the first time during a floristic survey of the Burrup Peninsula and adjacent areas (Trudgen & Associates 2002), then further collected during the then Department of Environment and Conservation's (now Department of Parks and Wildlife) 'Pilbara Biological Survey'. Although PERTH holds sufficient specimens of *V. sp.* Hamersley Clay and it is clearly distinct from *V. lanceolata s. str.* it is not described herein pending resolution of its status relative to the central Australian taxon *V. sp.* McDonald Downs Station (R.A. Perry 3416).

### Methods

This study is based on the examination of herbarium specimens at BRI, DNA and PERTH and field observations. Vegetative, fruit and indumentum characters were scored from dried material and floral characters were scored from fresh and rehydrated flowers. Herbarium acronyms follow Thiers (continuously updated).

The distribution map was prepared using QGIS Version 2.8.1 from PERTH specimen data, and shows *Interim Biogeographical Regionalisation for Australia (IBRA) Version 7* boundaries (Department of the Environment 2013).

### Taxonomy

***Vigna triodiophila*** A.E.Holland & R.Butcher, *sp. nov.*

*Typus*: near Harding Dam, south of Roebourne, Western Australia [precise locality withheld for conservation reasons], 28 May 2009, R. Butcher, K. Shepherd & J.A. Wege RB 1400 (*holo*: PERTH 07905718; *iso*: BRI, CANB, DNA).

*Vigna sp.* rockpiles (R. Butcher et al. RB 1400), Western Australian Herbarium, in *FloraBase*, <https://florabase.dpaw.wa.gov.au/> [accessed 20 October 2015].

*Vigna sp.* Burrup (B18), M.E. Trudgen & Associates, in *A Flora, Vegetation and Floristic Survey of the Burrup Peninsula...* Vol. 1. p. 59 (2002).

*Vigna sp.* Harding Dam (HD 189-12), M.E. Trudgen & Associates, in *A Flora, Vegetation and Floristic Survey of the Burrup Peninsula...* Vol. 1. p. 77–78 (2002).

Fine-stemmed prostrate or scrambling *vine* with a woody root with annual stems from a woody base, sometimes rooting at nodes. *Rhizomes* absent; *tubers* absent. *Stems* several, up to 1 m long, 0.5–0.7 mm diam., not or slightly twining to curving but sometimes forming an intricate mass or mat, glabrous or with a few fine, white, appressed, retrorse hairs, 0.2–0.3 mm long. *Leaves* monomorphic; *petioles* 0.6–3.2 cm long; *rachis* 1.5–6.0 mm long; *stipels* 0.5–1.0 mm long. *Terminal leaflets* ovate to elliptic, glabrous or nearly so, 0.8–2.3(–3) cm long, 0.6–1.6(–2.1) cm wide, *L:W* ratio 1.1–2.3; acute or obtuse

or occasionally retuse at apex; cuneate and 3-veined at base, coriaceous, shiny, glabrous or with a few scattered hairs, and evenly green; *veins* prominent on both surfaces, lateral veins forming an angle of 40–60° to the midrib; *hairs* when present, sparse, white, appressed, 0.1–0.3 mm long, *lobes* absent; *lateral leaflets* similar, slightly smaller than terminal leaflets. *Stipules* triangular, 1.2–2.3 mm long, 0.9–1.4 mm wide, with 5–7 prominent veins, glabrous or with fine hairs towards the apex; apex acute or obtuse; base somewhat obliquely cordate. *Aerial inflorescences* with 2–4 flowers, developing sequentially in pairs (pairs somewhat asynchronous in flowering), crowded towards apex; *extrafloral nectaries* on a swollen tubercle between each pair of flowers. *Peduncle* round in cross-section, 3–13 cm long, 0.4–0.6 mm diameter; *pedicel* 0.9–3.0 mm long; *bracts* caducous; *bracteoles* inserted at base of calyx, ovate, 0.6–1.3 mm long, ciliate. *Calyx* campanulate, 2–3 mm long, glabrous, ciliolate; *lobes* triangular, 0.6–1.5 mm long, shorter than the tube; upper two lobes joined almost the entire length; lower lobes longest, triangular, acute. *Corolla* yellow with a greenish keel, glabrous. *Standard* transversely elliptic, emarginate, 6–7 mm long, 9–10 mm wide; the inner surface yellow, greenish at throat, with two longitudinal ridges *c.* 1 mm long and curved towards the midrib at base to form shallow U-shaped ridges; outer surface with a reddish infusion along the midvein towards apex; veins visible, reddish; base somewhat auriculate; claw *c.* 1 mm long. *Wings* obovate, clasping the keel, 5–6 mm long, 3–4 mm wide, yellow; the apex broadly rounded and descending to partly cover the keel (slightly longer than keel); margins smooth (not spurred); claw *c.* 2 mm long. *Keel* 4.5–5.5 mm long, 4.5–5.0 mm wide, pale yellow-green; upper margin with a distinct downward pocket near base; lower margin strongly curved; beak strongly upturned and slightly twisted (*c.* 90°); claw *c.* 2 mm long. *Filament tube c.* 6 mm long, strongly upturned; filaments free for *c.* 1/3 of their length; *anthers c.* 0.5 mm long. *Ovary* pubescent, *c.* 3 mm long; *style* terete, strongly upturned, anterior face hairy for *c.* 1/3 the length; stigma situated near apex; style prolonged past stigma into a tight curve of *c.* 90° away from stigma. *Aerial legumes* slightly curved, 2.0–2.5 cm long, 4–6 mm wide, sparsely pubescent with short, appressed hairs or glabrous, pale brown, mottled, with 4 or 5 seeds. *Seeds* more or less orbicular-lenticular, dark reddish brown, sometimes dark-mottled, 3.5–4.2 mm long, 3.0–3.2 mm wide, 1.6–2.0 mm thick; hilum *c.* 0.8 mm long. *Subterranean inflorescences* absent. (Figure 1)

*Diagnostic features.* Differs from other *Vigna* species in the *V. lanceolata* complex by the sprawling mat-forming habit, the small, ovate to elliptic leaves to 2.3 cm long, occasionally to 3 cm long, the small flowers 6–7 mm long, and the short pods to 2.5 cm long. The stems and peduncles are usually finer, less than 1 mm in diameter. Rhizomes and subterranean inflorescences are common in other taxa in the complex but are completely absent in this species (pers. observ.).

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 26 May 2009, R. Butcher, K. Shepherd, J.A. Wege & S. van Leeuwen RB 1375 (BRI, PERTH); 29 May 2009, R. Butcher, K. Shepherd & J.A. Wege RB 1405 (BRI, PERTH); 4 June 2000, V. Long MET & A 082 (PERTH); 4 June 2000, V. Long MET & A 083 (PERTH); 22 May 2000, V. Long MET & A 086 (PERTH); 9 June 2011, V. Long VL Burrep 11-12 (CANB, DNA, PERTH); 21 May 2000, M.E. Trudgen 23524 (PERTH); 21 May 2000, M.E. Trudgen 23533 (PERTH); 14 May 2004, S. van Leeuwen et al. 0019 (PERTH); 10 Sep. 2004, S. van Leeuwen et al. 0020 (PERTH); 23 Aug. 2005, S. van Leeuwen et al. 0021 (PERTH); 21 May 2000, A. Weston MET & A 085 (PERTH).

*Phenology.* Known to flower and fruit between May and September.

*Distribution and habitat.* This species is apparently endemic to basalt rockpile habitats in the north-west of the Pilbara bioregion, where PERTH specimen records show it is currently known from seven populations at three locations within 80 km<sup>2</sup>, centred on Karratha (Western Australian Herbarium 1998–; Figure 2). Trudgen and Associates (2002) recorded the species from an additional five populations on

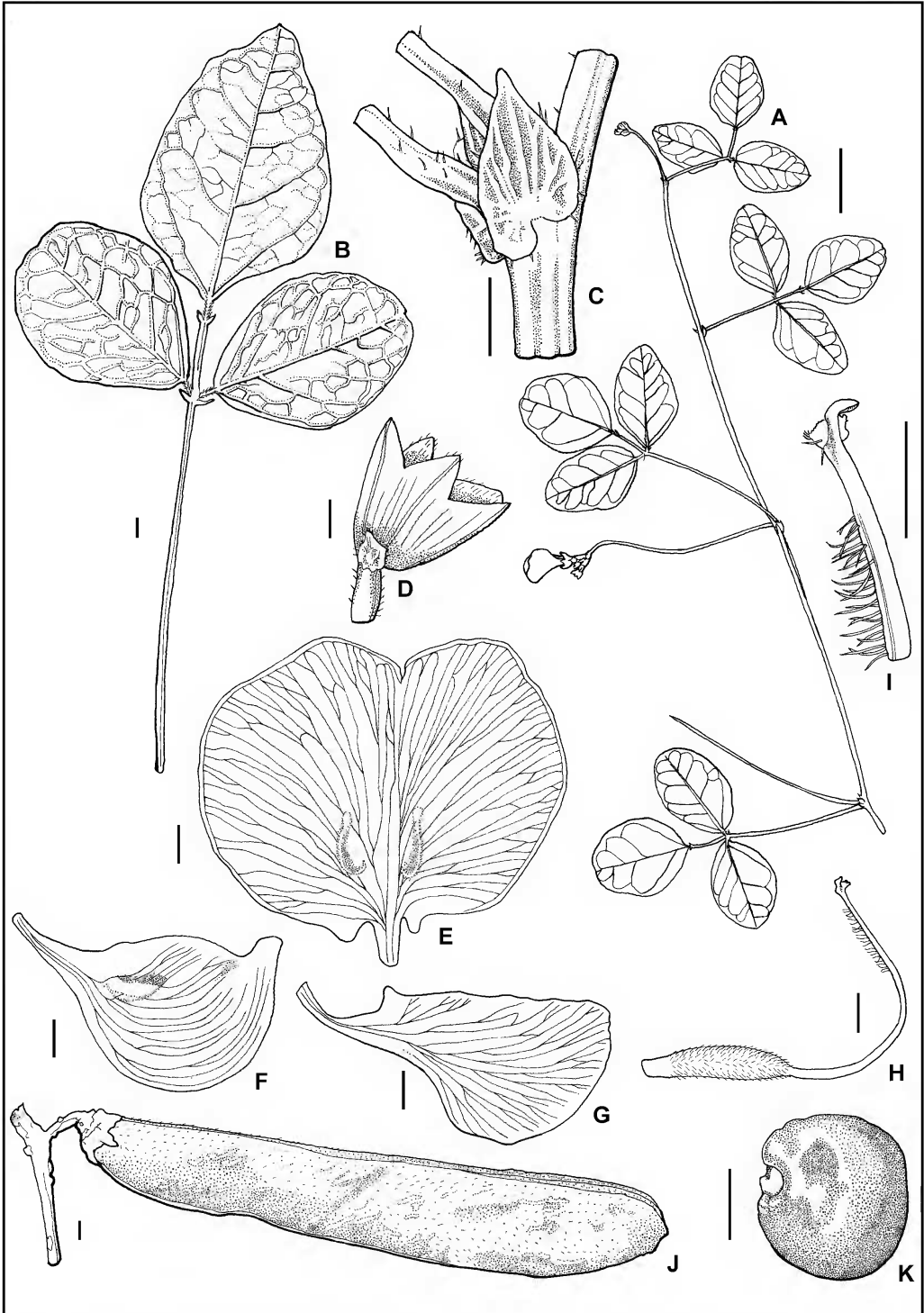


Figure 1. *Vigna triodiophila*. A – habit; B – leaf; C – stipule; D – calyx; E – standard; F – keel; G – wing; H – ovary and style; I – style and stigma; J – pod; K – seed. Scale bars = 1 cm (A); 1 mm (B–J). Drawn by Will Smith from S. van Leeuwen 0019.

the Burrup Peninsula and a survey site c. 162 km south-east of Port Hedland, but these collections are not at PERTH. *Vigna triodiophila* grows in association with rockpiles among cobbles and boulders in shallow, red-brown or brown, clayey sand or loam (Figure 3). Associated vegetation comprises open to scattered shrubs, tall shrubs and low trees of *Acacia bivenosa*, *A. coriacea* subsp. *pendens*, *A. inaequilatera*, *A. pyriformis*, *Brachychiton acuminatus*, *Dichrostachys spicata*, *Eremophila longifolia*, *Flueggea virosa* subsp. *melanthesoides* and *Grevillea pyramidalis* subsp. *pyramidalis*, over low shrubs and lianas including *Indigofera monophylla*, *Ipomoea costata*, *Rhagodia eremaea*, *Rhynchosia bungarensis*, *R. minima* and *Scaevola spinescens*, with hummock and tussock grasslands of *Aristida nitidula*, *Cymbopogon ambiguus*, *Eriachne mucronata*, *Triodia angusta*, *T. epactia* and *T. wiseana*.

**Conservation status.** Listed as Priority Three under Department of Parks and Wildlife Conservation Codes for Western Australian Flora as *Vigna* sp. rockpiles (R. Butcher et al. RB 1400) (Jones 2015), and not listed under IUCN categories (IUCN 2001). Although none of the known populations of *V. triodiophila* are currently within conservation reserves they are regarded as secure as their rockpile habitat is not considered prospective for minerals. However, populations on the Burrup Peninsula are threatened by *Passiflora foetida* weed invasion (V. Long pers. comm. 2010) and a number of collections record the invasive species *Cenchrus ciliaris*.

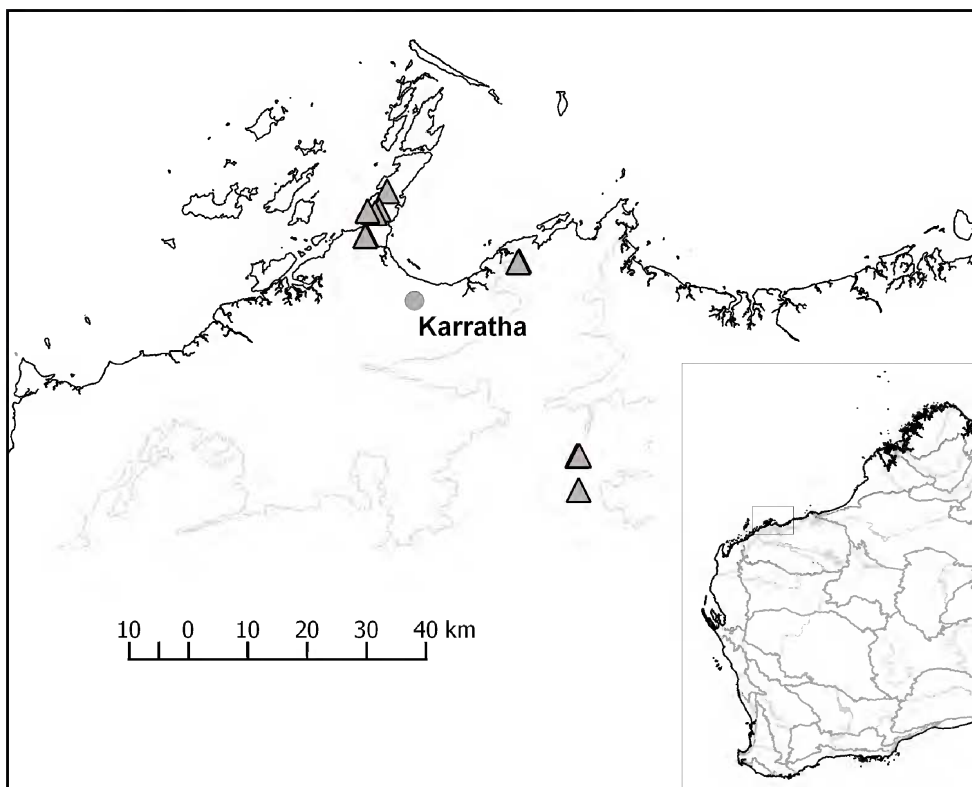


Figure 2. Distribution of *Vigna triodiophila* (▲) in the west Pilbara bioregion of north-west Western Australia. Inset shows the location of the distribution area; *Interim Biogeographic Regionalisation for Australia version 7* bioregions are shown in grey, with subregions in light grey.



Figure 3. A – habit of *Vigna triodiophila* intermingled with *Triodia angusta*; B – typical habitat of *V. triodiophila* at Harding Dam (R. Butcher in the foreground collecting the type). Photos by J.A. Wege.

*Etymology.* The specific epithet refers to this species' proclivity for growing among and through the spinifex hummocks associated with its rockpile habitat (*Triodia* spp.; Gk. *-philus*, -loving) (Figure 3).

*Affinities.* *Vigna triodiophila* is a distinctive species and not likely to be confused with either *V. lanceolata* var. *lanceolata* or *V. sp.* Hamersley Clay, the only other taxa in the Pilbara. These taxa are robust and rhizomatous, with terminal leaflets usually longer than 2 cm, and subterranean inflorescences. Both have large (aerial) flowers more than 7 mm long, on robust peduncles more than 0.7 mm in diameter (usually more than 1 mm diam.), and aerial pods mostly more than 25 mm long. *Vigna lanceolata* var. *lanceolata* is a widespread and variable taxon occurring across northern Australia, and is characterised by leaflets that have a central silver stripe and lateral leaflets with lobes. *Vigna sp.* Hamersley Clay is part of a species complex that includes *V. sp.* McDonald Downs Station and spreads into Central Australia. It has characteristically large, usually rounded and uniformly green leaflets (lacking a silver stripe) and the lateral leaflets lack obvious lobes. *Vigna sp.* Hamersley Clay and *V. sp.* McDonald Downs Station both have underground (geocarpic) as well as aerial inflorescences; they are the subject of ongoing investigations.

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### References

- Butcher, R. & Dillon, S.J. (2016). *Vigna sp.* central (M.E. Trudgen 1626) (Fabaceae: Phaseoleae) is not distinct from *V. sp.* Hamersley Clay (A.A. Mitchell PRP 113). *Nuytsia* 27: 31–32.
- Council of Heads of Australasian Herbaria (2015). *Australia's Virtual Herbarium*. <http://avh.ala.org.au/> [accessed 9 November 2015].
- Department of the Environment (2013). *Australia's bioregions (IBRA)*, IBRA7, Commonwealth of Australia. <http://www.environment.gov.au/land/nrs/science/ibra#ibra> [accessed 20 October 2015].
- Fery, R.L. (2002). New opportunities in *Vigna*. In: Janick, J. & Whipkey, A. (eds) *Trends in new crops and new uses*. pp. 424–428. (ASHS Press: Alexandria, VA.)
- IUCN (2001). *IUCN Red List Categories and Criteria Version 3.1*. IUCN - The World Conservation Union: Gland (Switzerland).
- Jones, A. (2015). *Threatened and Priority Flora list for Western Australia*. (Department of Parks and Wildlife: Kensington, Western Australia)
- Lawn, R.J. & Cottrell, A. (1988). Wild mungbean and its relatives in Australia. *Biologist* 35: 267–273.
- Lawn, R.J. & Watkinson, A.R. (2002). Habitats, morphological diversity, and distribution of the genus *Vigna* Savi in Australia. *Australian Journal of Agricultural Research* 53: 1305–1316.
- Smartt, J. & Hymanowitz, T. (1985). Domestication and evolution of grain legumes. In: Summerfield, R.J. & Roberts, E.H. (eds) *Grain legume crops*. pp. 37–72. (William Collins Sons & Co. Ltd.: London.)
- Thiers, B. (continuously updated). *Index Herbariorum: a global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/science/ih/> [accessed 20 October 2015].
- Trudgen, M.E. & Associates (2002). *A flora, vegetation and floristic survey of the Burrup Peninsula, some adjoining areas and part of the Dampier Archipelago, with comparisons to the floristics of areas on the adjoining mainland*. Vols. 1 & 2. Unpublished report by M.E. Trudgen and Associates for the Department of Mineral and Petroleum Resources, Perth.
- Western Australian Herbarium (1998–). *FloraBase—the Western Australian Flora*. <https://florabase.dpaw.wa.gov.au/> (Department of Parks and Wildlife: Kensington, Western Australia) [accessed 20 October 2015].